ECO Solutions, Inc.

HOECHST CELANESE CHEMICAL GROUP, INC.
Bay City Plant

PRESSURE FALLOFF AND MECHANICAL INTEGRITY TESTING FOR WDW-110 (Well #1-A)

Prepared by:

ECO Solutions, Inc.
10333 Richmond, Suite 250
Houston, Texas 77042

April 1994

Job No. 94-004

Hoechst Celanese

Chemical Group
Hoechst Celanese Corporation
Bay City Plant
PO Box 509
Highway 3057
Bay City, TX 77404-0509

April 27, 1994
IOC-038-94

CERTIFIED MAIL

Mr. Ben K. Knape - Head
UIC Team
UIC, Uranium and Radioactive Waste Section
Industrial and Hazardous Waste Division
Texas Natural Resource Conservation Commission
P. O. Box 13087
1700 North Congress Avenue
Austin, Texas 78711-3087

Subject: **PRESSURE FALLOFF MECHANICAL INTEGRITY TESTING (MIT) REPORT FOR WDW-110**

Dear Mr. Knape:

Enclosed are two copies of the Pressure Falloff and MIT report for WDW-110 which are provided for your review and approval. As you are aware, the testing occurred between February 21st and March 28th, 1994 and was performed by our Contractor, ECO Solutions, Inc., Houston, Texas.

Please don't hesitate to contact me at 409/241-4197 if you have comments and/or questions concerning the report.

Very truly yours,

I. O. Coleman, Jr. /cjs

I. O. Coleman, Jr.
Environmental Section Leader

IOC/cjs
attachment

cc: Mr. Laurence G. Walker, Geologist
UIC Team
Industrial and Hazardous Waste Division
Texas Natural Resource Conservation Commission
P. O. Box 13087
Austin, Texas 78711-3087

Mr. Phil Dellinger - **CERTIFIED MAIL** - w/report
Underground Injection Control Program
Environmental Protection Agency
1445 Ross Avenue, Suite #1200
Dallas, Texas 75202-2733

RECEIVED MAY - 3 1994

Hoechst

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APPENDICES

1.0 INTRODUCTION

1.1 INTRODUCTION

Hoechst Celanese Chemical Group, Inc. (HCCG) contracted ECO Solutions, Inc. (ECO) to conduct the annual mechanical integrity testing on WDW-110 (Well #1-A), HCCG's Class I injection well located at the Bay City facility. A schematic of the well is included as Figure 1. The attached report details the data and test results associated with that testing.

The following provides an overview of the key elements of the testing:

* An annulus pressure test was conducted to satisfy the annual mechanical integrity test requirements of the Texas Natural Resource Conservation Commission (TNRCC).

* A radioactive tracer survey was conducted to satisfy the annual requirements of the TNRCC.

* Pressure fall-off testing was conducted to satisfy the annual requirements of the U.S. Environmental Protection Agency (EPA) and the TNRCC.

The annulus pressure test was conducted on Monday, February 21, 1994 and the radioactive tracer was conducted on March 25, 1994. The testing was supervised by Mr. Robert Hall of ECO Solutions and witnessed by Mr. Larry Walker of the TNRCC and Mr. Ray Horton of HCCG.

1.2 EXECUTIVE SUMMARY

WDW-110 successfully passed the 1994 annual mechanical integrity test conducted on March 28, 1994. Mr. Larry Walker of the TNRCC gave verbal approval to place the well back in service after completion of the test.

Radioactive Tracer Survey

The analysis of the radioactive tracer survey (RAT) performed on March 25, 1994 demonstrated that no upward fluid movement from the injection interval is occurring. The RAT checked for upward fluid movement using three separate tests. All three showed no evidence of upward migration. This interpretation was supported by an independent evaluation performed by Western Atlas and included in Appendix A of this report.

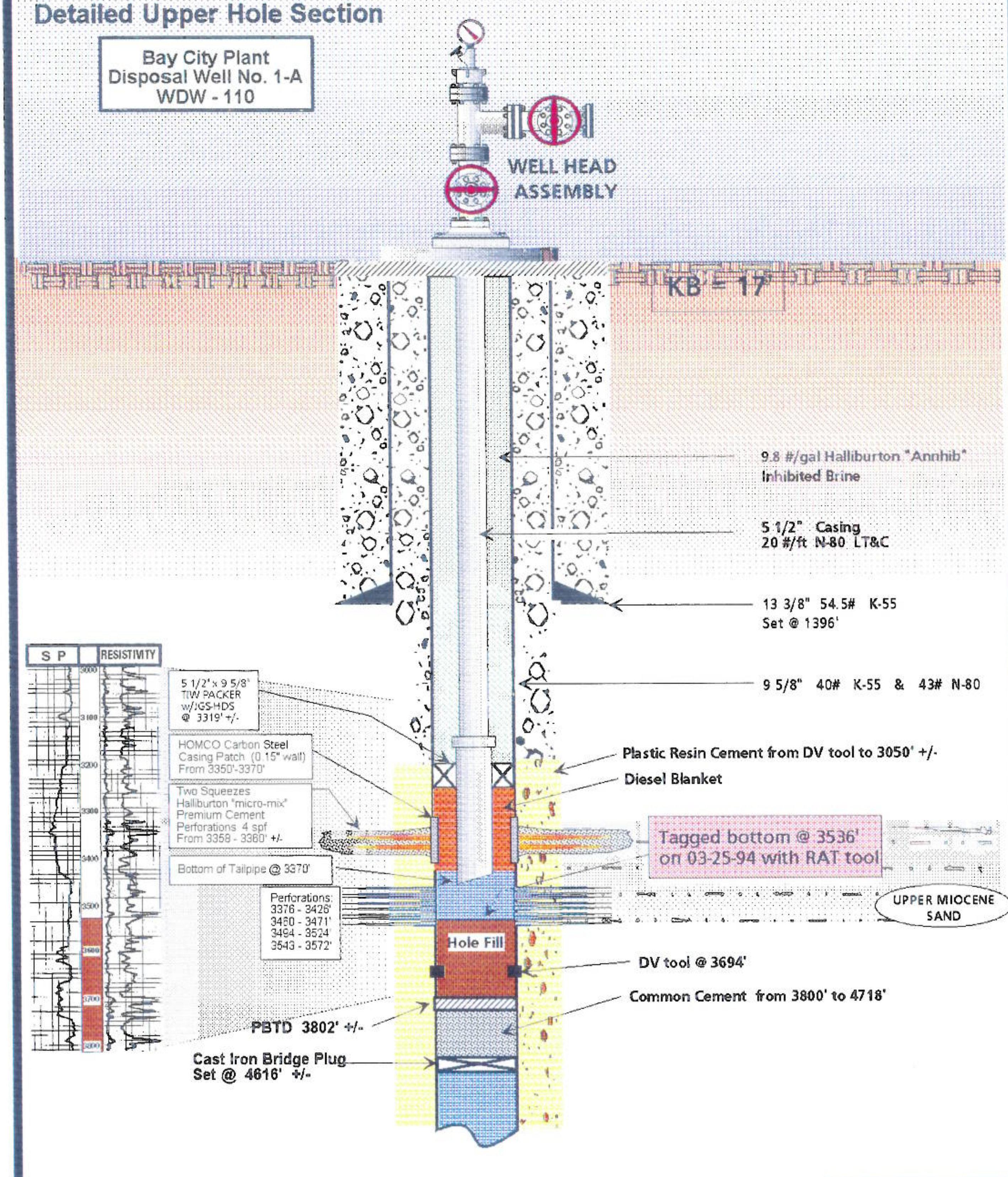
Annulus Pressure Test

A demonstration of a leak-free annulus was supported by an annulus pressure test (APT). The annulus was pressurized to 1092 psig on February 21, 1994 for a thirty minute test. At the end of the thirty minute test the annulus pressure had decreased to 1082 psig. The total pressure loss of 10 psi is within the 5% pressure loss criteria set by the TNRCC. Annulus pressure test plots and data are included in Appendix B.

HOECHST CELANESE CHEMICAL GROUP, INC.

Detailed Upper Hole Section

Bay City Plant
Disposal Well No. 1-A
WDW - 110



Hoechst Celanese Chemical Group, Inc. - WDW-110 (Well #1-A)

EVENT TIMELINE

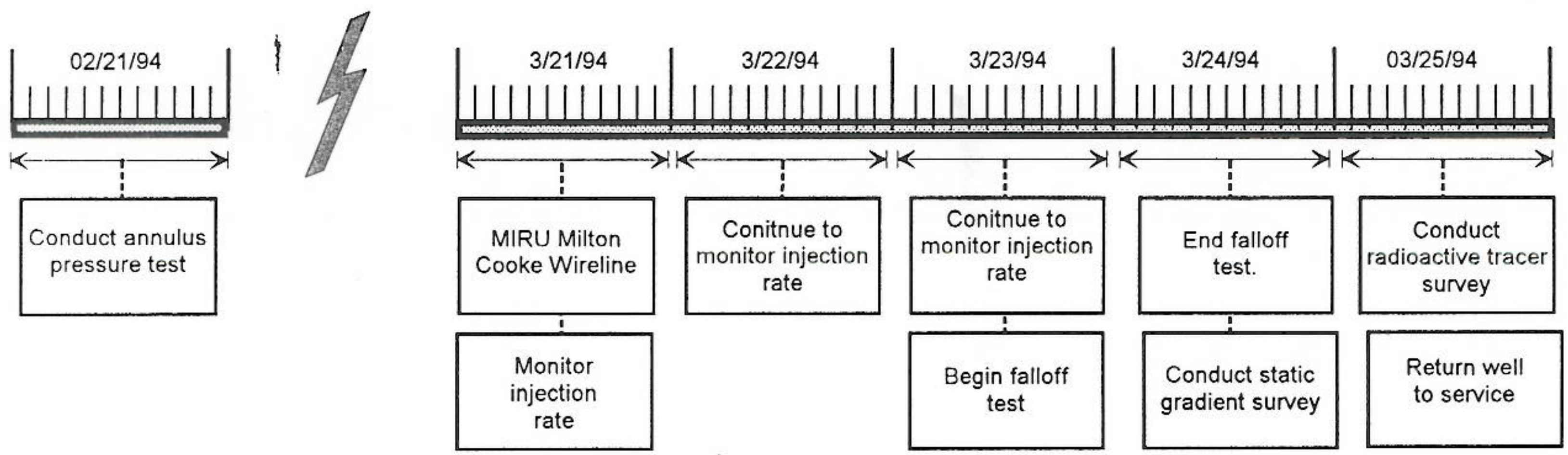


TABLE OF EVENTS

2/21/94	3/21/94	3/22/94	3/23/94	3/24/94	3/25/94
Conducted annulus pressure test. Witnessed by Mr. Larry Walker of the TNRCC.	Move in and rigged up Milton Cooke Wireline. Ran in hole with gauge. Monitored injection rate.	Continued to monitor injection rate.	Continued to monitor the injection rate. Began fall-off testing.	Ended fall-off test. Conducted static gradient survey.	Conducted radioactive tracer survey. Returned well to service.

ECO Solutions, Inc.
Houston, Texas

2.0 FIELD OPERATIONS SUMMARY

Monday, February 21, 1994

HCCG personnel pressurized the annulus to 1092 psig for the thirty minute test. The corresponding shut-in tubing pressure was 70 psig at the beginning of the thirty minute test. At the end of the test the annulus pressure had decreased to 1082 psig with a corresponding shut-in tubing pressure of 70 psig. Pressure test successful. Mr. Larry Walker, TNRCC inspector, on location to witness test.

Monday, March 21, 1994

Milton Cooke Wireline arrived at the Bay City Plant and checked in at the front gate. Moved in and rigged up on WDW-110. Other equipment moved from WDW-49 (Well #4). Met with Ray Horton and reviewed test procedures and current injection condition of all wells.

WDW-14 (Well #2)	Out of service Friday, February 18, 1994
WDW-32 (Well #3)	Out of service Friday, March 11, 1994
WDW-49 (Well #4)	Out of service Thursday, March 17, 1994
WDW-110 (Well #1-A)	Maintaining constant rate since Friday, Marcl. 18, 1994

Begin GRC Data Acquisition System (GRC EPG-520 gauge, Serial #69491). Pressured up lubricator with surface readout and memory gauge back-up tool string. Adjusted wireline counter, prepared to go in hole.

Ran in hole with well injecting at 280 gpm, surface injection pressure 315 psig. Ran gauge to 3,430' and began logging with collar locator. Tied into end of tubing at 3,382'. Continued in hole and tagged top of fill at 3,359'. Pulled up hole and set gauge at test depth of 3,300'. Monitored bottom hole injection pressure and temperature.

Injection Rate	280 gpm
Bottom hole injection pressure	1724 psia
Surface injection pressure	314 psi

Tuesday, March 22, 1994

Continued to monitor injection period.

Injection Rate	278 gpm
Bottom hole injection pressure	1731 psia
Surface injection pressure	320 psi

Generated Cartesian curve to evaluate pressure stability. Cartesian plot indicated a slight pressure deviation. Discussed the possible cause with Ray Horton and the night operators. The heat exchanger is not in service, pressure deviation possibly caused by temperature sensitivity. Put heat exchanger back in service.

Checked motor valve controller to verify operation. Motor valve and rate meter were responsive. Continued to monitor injection period.

Injection Rate	280 gpm
Bottom hole injection pressure	1736 psia
Surface injection pressure	316 psi

Flow rate fluctuating from approximately 286 gpm to 280 gpm. Investigated possible causes. Shut-in boiler feed water system on the well (boiler feed water used to maintain proper differential on casing).

Wednesday, March 23, 1994

Continued to monitor injection period.

Injection Rate	280 gpm
Bottom hole injection pressure	1735 psia
Surface injection pressure	320 psi

Generated Cartesian curve to evaluate pressure stability. Cartesian plot still indicated slight pressure deviation. Discussed possible causes with Ray Horton and operators. Decreased injection rate to 160 gpm for 25 minutes and increased injection rate back up to 280 gpm. Continued to monitor injection period.

Injection Rate	280 gpm
Bottom hole injection pressure	1724 psia
Surface injection pressure	314 psi

Flow rate and bottom hole pressure stabilized, prepared for fall-off test.

Shut down injection pump at Control Room 2. Began fall-off test.

Injection Rate	279 gpm
Bottom hole injection pressure	1753 psia
Surface injection pressure	320 psi

Continued to monitor fall-off period.

Bottom hole shut-in pressure	1577 psia
Surface shut-in pressure	83 psi

Thursday, March 24, 1994

Continued to monitor fall-off period.

Bottom hole shut-in pressure	1513 psia
Surface shut-in pressure	78 psig

Generated Semi-Log and Log-Log curves for observation. Pressure derivative curve and semi-log indicated radial flow period had been obtained. Prepared to end fall-off test. Monitored fall-off test for five more hours, ended fall-off test.

Bottom hole shut-in pressure	1513 psia
Surface shut-in pressure	78 psig

Dropped tool downhole to tag bottom. Began pulling out of hole, making static gradient stops. Completed static gradient survey. Bled down lubricator and rigged down Milton Cooke Wireline.

Friday, March 25, 1994

Western Atlas personnel attended the plant orientation at the front gate and then the unit specific orientation at the well. Western Atlas Wireline was rigged up to run Radioactive Tracer (RAT) survey.

Reviewed log with Mr. Larry Walker of TNRCC, verbal approval given to place well back in service. Pulled out of the hole and rigged down Western Atlas.

3.0 PRESSURE FALL-OFF

3.1 PRESSURE FALL-OFF TESTING

Pressure fall-off testing commenced on March 21, 1994 and concluded on March 24, 1994. The flowing bottomhole pressure was monitored for a total of 52 hours followed by a 21 hour shut-in period. The period of last shut-in was March 11 - 18, 1994. Flow data is shown in Table 3.3 and a graphic presentation of injection versus days for this 5 day period is included as Figure 2. Plots and data for the fall-off test are included in Appendices A and B, respectively.

Date	Injection Rate (gpm)
3/19/94	268
3/20/94	277
3/21/94	279
3/22/94	281
3/23/94	185

3.2 PRESSURE FALL-OFF ANALYSIS

The following analysis was performed by utilizing both Semi-Log and Log-Log analysis. A) The Semi-Log curve was generated by plotting Pressure vs. the Superposition time function utilizing the given rate history. The semi-log straight line was then calculated by linear regression through the infinite acting flow period of the fall-off curve. The semi-log slope and P_{1hr} values were obtained from the semi=log straight line and utilized for the final permeability and skin calculations. B) The Log-Log curves were generated by plotting Delta-P/Delta-Q and Pressure derivative vs. the Agarwal equivalent time function. The Log-Log curves were simultaneously positioned over $[T_D/C_D]$ Wellbore Storage Type-curves until a solution match was obtained. Permeability and skin values were calculated from this match and then compared with those obtained from the Semi-Log analysis.

Semi-Log (Superposition) - The straight line area of the semi-log curve was identified by first using the 1-1/2 log cycle rule to estimate the end of wellbore storage effects. Secondly, the time of the flat portion from the Pressure Derivative curve was used in determining the area of the semi-log curve in which the straight line was drawn. The semi-log straight line yielded a slope value of 5.3075 psi/cycle and a P_{1hr} of 1520 psi. The pressure difference between P_{1hr} and the injection pressure followed with the calculated slope would give indications of positive skin damage and high permeability.

Log-Log ([T_D/C_D] Wellbore storage Type-curves) - The high maxim of the derivative curve illustrates wellbore storage and positive skin effects. The flattening portion of the derivative indicating the infinite acting flow period of the curve was observed approximately 0.9 hours following the start time of the fall-off period. The flat portion of the derivative curve was the main factor used to obtain a type curve match yielding similar results to the semi-log analysis. The derivative curve illustrated an upward trend following the radial flow period of the test. This was also observed in the semi-log plot by a slight increase in slope following the semi-log straight line. This anomaly could possibly be due to the contact of the waste front and original formation fluid.

Conclusions - The system was diagnosed as a homogeneous reservoir with a calculated permeability of 1050 (md) and skin damage of +43.1 utilizing an h_{net} value of 165 feet. The flow efficiency of 19.1% suggests that the near wellbore conditions have large affects on the injection volume limitations and that the total pressure drop is primarily due to conditions within a small radius from the well.

The following table is provided to give comparative results with the previous test. The primary variables affecting the calculated results are included.

Date	Rate	h_{net}	Uw	Slope	kh/u	k	S
MM/YY	GPM	ft	cp	psi/cyl	md-ft	md	--
02/93	200	165	0.5560	3.2000	348621	1174.8	+ 29.1
03/94	279	165	0.5914	5.3075	293000	1050.2	+ 43.1

The calculated results indicate a difference in transmissibility, (kh/u) of 15.9% and a difference in skin of 32.5% between the two tests. The increase in skin is most likely caused by the increase in the fill determined in the present completion, which partially covers the bottom set of perforations. Last year the top of fill was tagged at 3,595 feet and this year the top of fill was tagged at 3,559 feet, an increase of 36 feet. The transmissibility and permeability values are fairly consistent between the two tests.

The time to exit the waste front exceeded the start time of the infinite acting flow period, therefore the viscosity of the injection fluid was used for the final analysis.

A homogeneous simulator was utilized to confirm the calculated results mentioned above. The main assumptions were as follows: a single well with infinite acting and radial flow conditions being injected at a constant rate with constant reservoir conditions such as porosity, permeability, and compressibility. Based on this particular reservoir the simulated data matched the actual data with a reasonable degree of accuracy.

The program used for final analysis and well simulation was "PanSystem 2.1", marketed by Edinburgh Petroleum Services.

Table 3.1
Fall-off Test Data - WDW-110 (Well #1-A)

1.	*General Test Information*	
	Date of Test	March 21 - 24, 1994
	Time since stabilized pressure (hrs.)	
	Cumulative injection (gals.)	gallons
	Wellbore radius (ft.)	0.3
	Gross completed interval (ft.)	120'
	Type of completion	Perforated
	Depth to fill	3,558'
	Justified interval thickness (ft.)	165'
	Average historical waste fluid viscosity (cps)	0.556
	Formation fluid viscosity (cps)	0.71
	Porosity (%)	33
	Total compressibility (psi^{-1})	$6.0x10^{-6}$
	Formation volume factor	1.0
	Initial formation bottomhole pressure (psia)	1501 (1968) @ 3,300'
2.	*Injection Period*	
	Time of injection period (hrs.)	52
	Injection rate (gallons per minute)	278.67
	Test fluid	Non-hazardous wastestream
	Pumps used for test	Byron Jackson - Centrifugal
	Injection fluid viscosity (cps)	0.5914
	Final injection pressure (psia)	1754.13
	Final injection temperature (°F)	99.76

Gauge type	GRC EPG-520 Serial # 69491
Gauge resolution and calibration	0.01
Gauge depth (feet)	3,300'

3. *Fall-off Period*

Total Shut-in Time (hrs.)	21
Final Shut-in Pressure (psia)	1512.40
Final Shut-in Temperature °F	103.90
Final Shut-in Tubing Pressure (psig)	78

Table 3.2 Average Injection Rate
March 11, 1994 - March 23, 1994

DATE	INJECTION RATE (gpm)
3/11/94	0
3/12/94	0
3/13/94	0
3/14/94	0
3/15/94	0
3/16/94	0
3/17/94	0
3/18/94	160
3/19/94	268
3/20/94	277
3/21/94	279
3/22/94	281
3/23/94	185

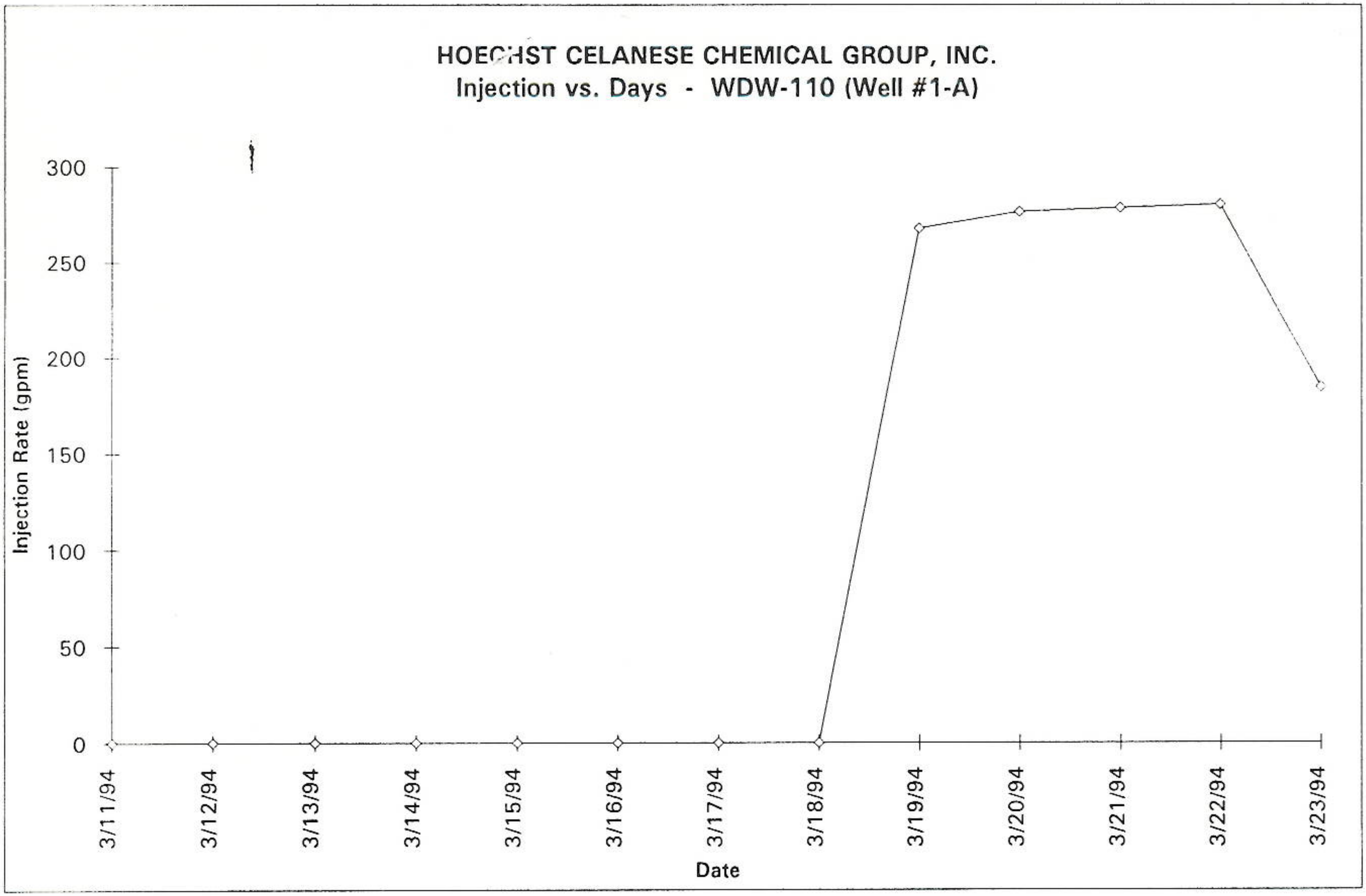
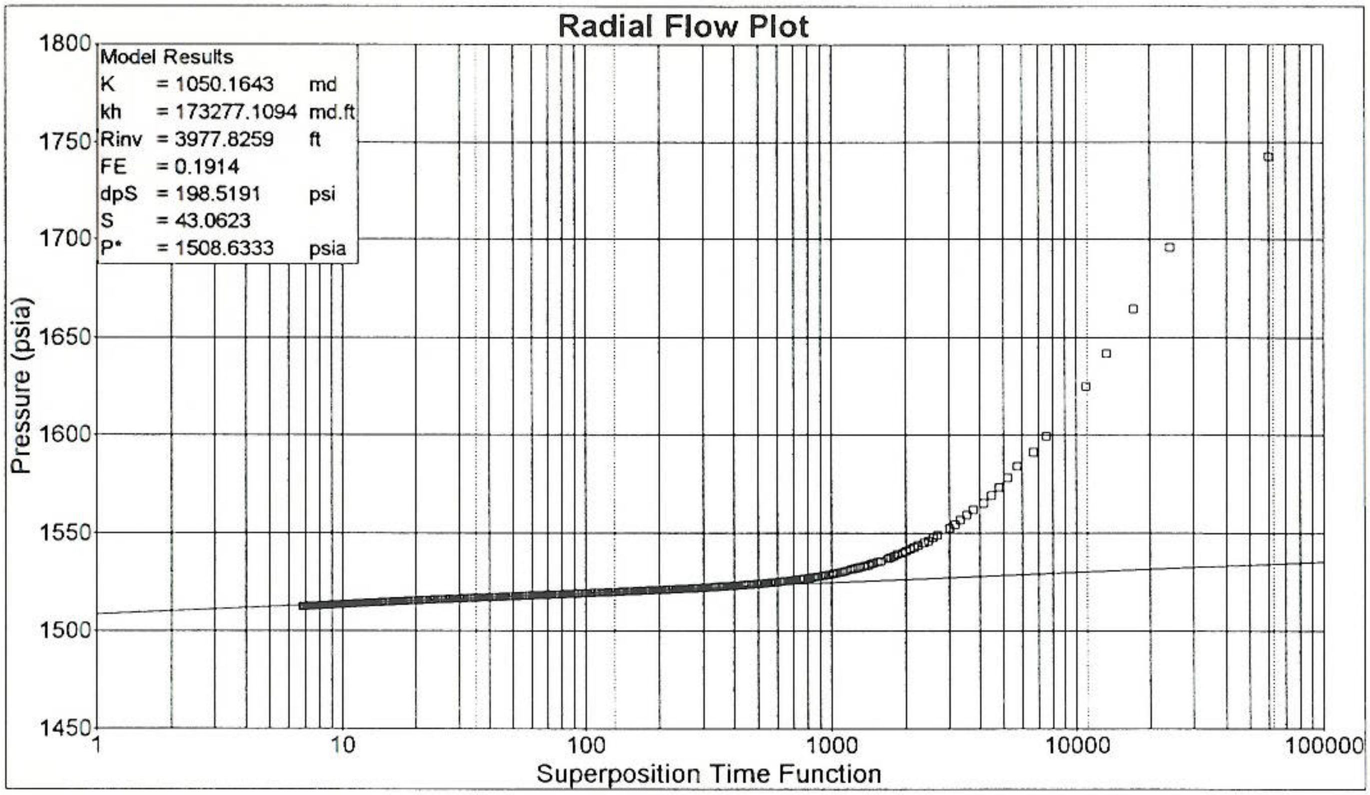


FIGURE 3

ECO SOLUTIONS, INC.

ECO Solutions, Inc.	Report File:	WDW110#1.PAN
MECHANICAL INTEGRITY TEST	Analysis Date:	4/15/94
Fall-Off Test Analysis		



HOECHST CELANESE CHEMICAL GROUP, INC.
WDW-110 Well # 1-A
Bay City Facility, Texas

03/21 - 24/1994

Semi-Log analysis utilizing Superposition Time Function.

Radial Flow Plot Line details

Line type : Radial flow

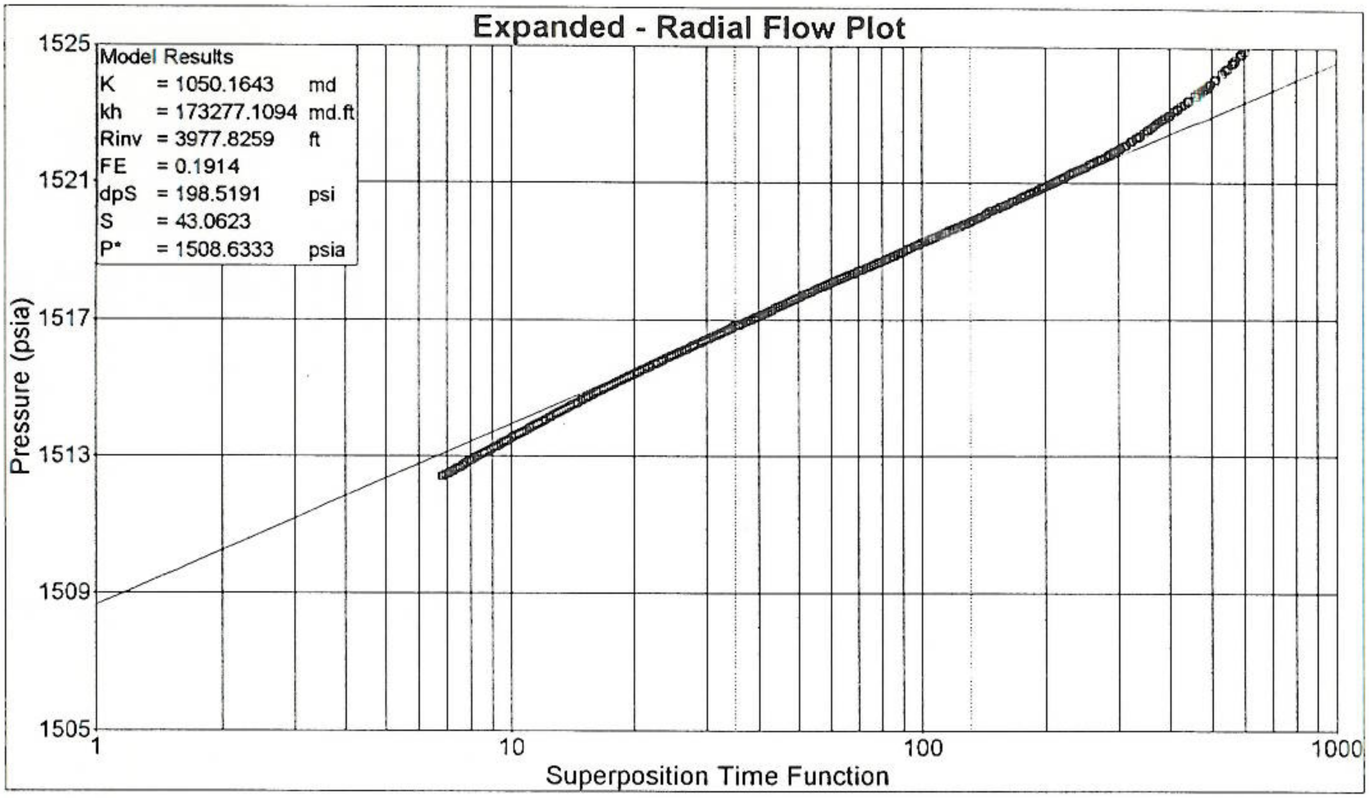
Slope : 5.30751

Intercept : 1508.63

Coefficient of Determination : 0.999804

FIGURE 4

ECO Solutions, Inc.	Report File:	WDW110#1.PAN
MECHANICAL INTEGRITY TEST	Analysis Date:	4/15/94
Fall-Off Test Analysis		



HOECHST CELANESE CHEMICAL GROUP, INC.
WDW-110 Well # 1-A
Bay City Facility, Texas

03/21 - 24/1994

Semi-Log analysis utilizing Superposition Time Function.

Expanded - Radial Flow Plot Line details

Line type : Radial flow

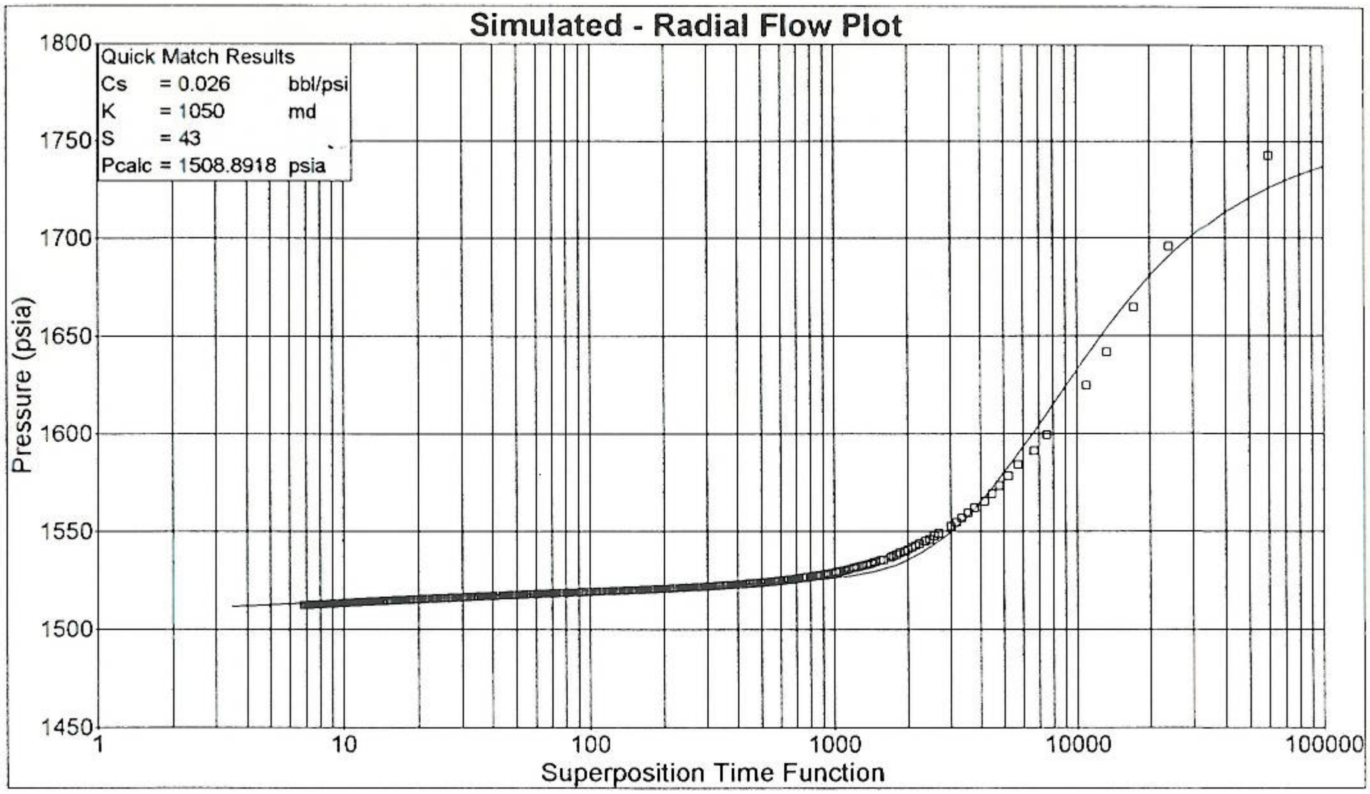
Slope : 5.30751

Intercept : 1508.63

Coefficient of Determination : 0.999804

FIGURE 5

ECO Solutions, Inc.	Report File:	WDW110#1.PAN
MECHANICAL INTEGRITY TEST	Analysis Date:	4/15/94
Fall-Off Test Analysis		



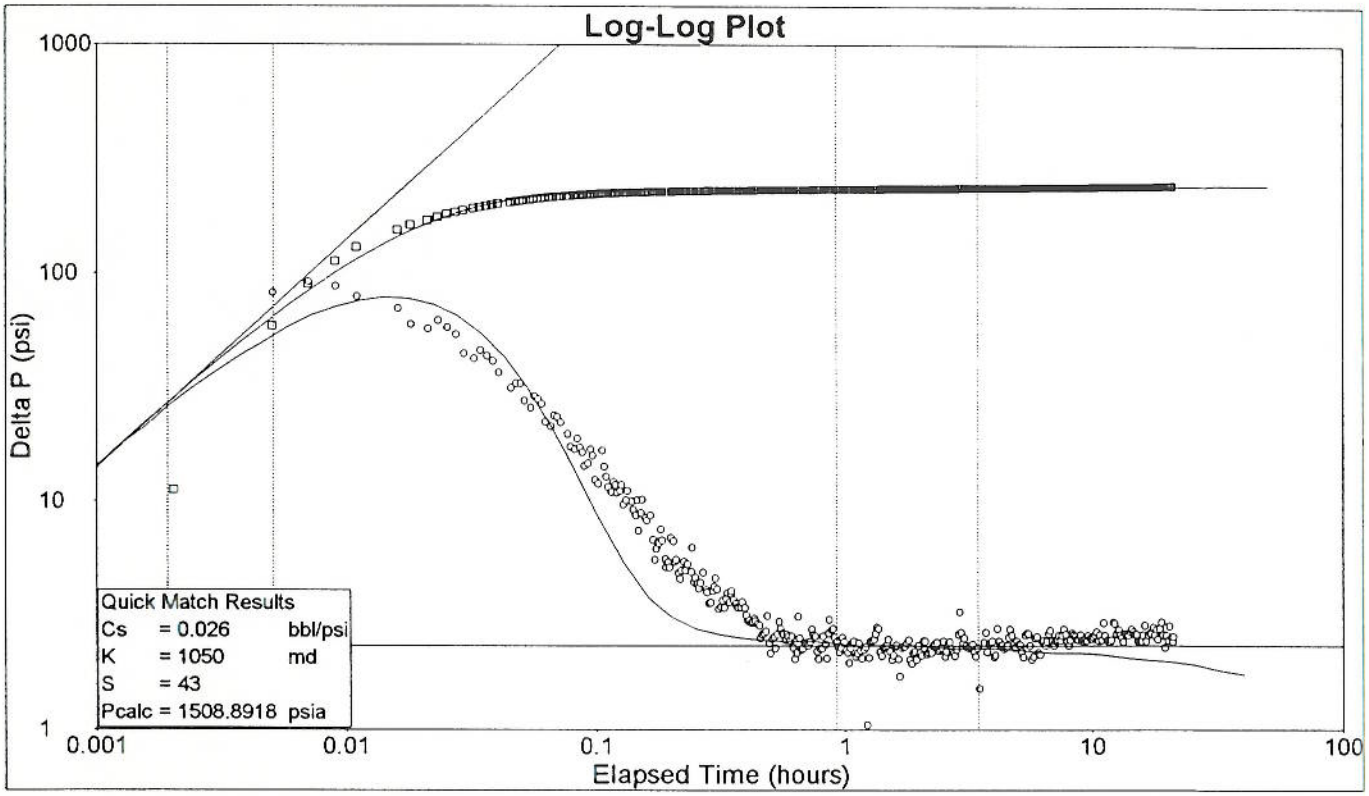
HOECHST CELANESE CHEMICAL GROUP, INC.
WDW-110 Well # 1-A
Bay City Facility, Texas

03/21 - 24/1994

Semi-Log analysis utilizing Superposition Time Function.

FIGURE 6

ECO Solutions, Inc.	Report File:	WDW110#1.PAN
MECHANICAL INTEGRITY TEST	Analysis Date:	4/15/94
Fall-Off Test Analysis		



HOECHST CELANESE CHEMICAL GROUP, INC.
WDW-110 Well # 1-A
Bay City Facility, Texas

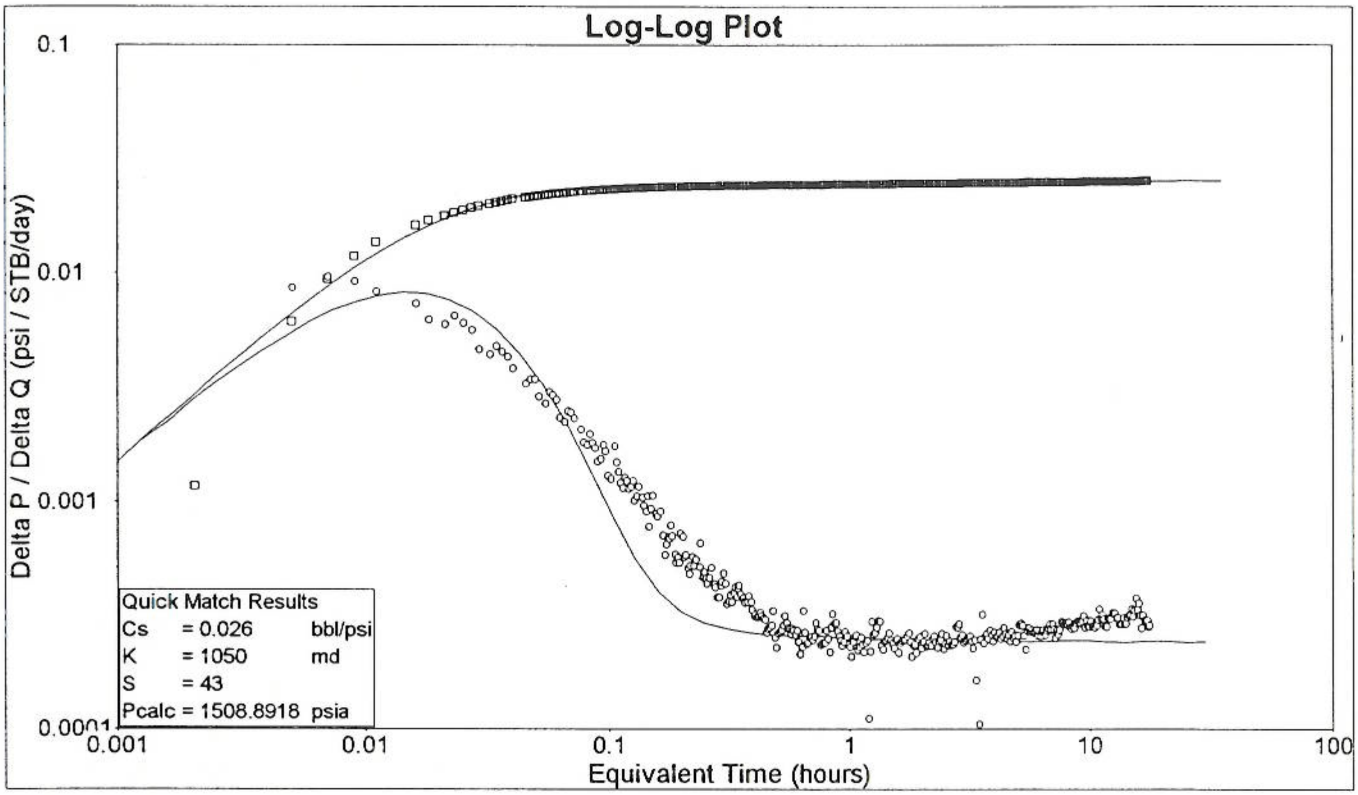
03/21 - 24/1994

Log-Log plot used to identify flow regimes.

End of unit slop:	Approximately 0.005 hours
Start of infinite acting flow period:	Approximately 0.9 hours
Time to exit waste front:	Approximately 1.6 hours

FIGURE 7

ECO Solutions, Inc.	Report File:	WDW110#1.PAN
MECHANICAL INTEGRITY TEST	Analysis Date:	4/15/94
Fall-Off Test Analysis		



HOECHST CELANESE CHEMICAL GROUP, INC.
WDW-110 Well # 1-A
Bay City Facility, Texas

03/21 - 24/1994

Log-Log analysis utilizing Equivalent time function.

FIGURE 8

4.0 MECHANICAL INTEGRITY TESTING

4.1 ANNULUS PRESSURE TEST

An annulus pressure test (APT) was conducted on Monday, February 21, 1994 in order to demonstrate a leak-free annulus. The APT was witnessed by Mr. Larry Walker of the TNRCC. The annulus was pressured up to 1092 psig with a corresponding shut-in tubing pressure of 70 psig for thirty minutes. At the end of the thirty minute test the annulus pressure decreased to 1082 psig with a corresponding tubing pressure of 70 psig. The 10 psi or 0.9% pressure loss is within the 5% allowable pressure loss criteria set by the TNRCC.

4.2 RADIOACTIVE TRACER SURVEY

On Friday, March 25, 1994 Western Atlas Wireline conducted a radioactive tracer (RAT) survey to insure that all fluids are entering the injection interval. Analysis of the RAT showed no upward fluid movement. Atlas conducted the RAT as follows:

1. Ran API gamma-ray tie in strip.
2. Ran #1 base log from 3,520' to 3,000'.
3. Ran #2 base log from 3,520' to 3,000'.
4. Made multiple pass survey #1 with a radioactive slug ejected at 3,113' and a pump rate of 26 gpm.
5. Made multiple pass survey #2 with a radioactive slug ejected at 3,113' and a pump rate of 26 gpm.
6. Ran stationary survey #1 at 3,360'. Watched slug pass tool and ran check for 15 minutes more. Pump rate was 100 gpm.
7. Ran stationary survey #2 at 3,360'. Watched slug pass tool and ran check for 15 minutes more. Pump rate at 100 gpm.
8. Ran after survey base log from 3,520' to 3,000'.

4.3 STATIC GRADIENT SURVEY

The static gradient survey was run while pulling out of the hole after the pressure fall-off testing. Readings were taken at 3,300' and every 1,000 feet from 3,000' to 1,000' and again at 500'. Table 4.1 shows the depth, pressure and psi/ft for each of the stops and Figure 11 graphically shows the gradient survey. Data for the static gradient survey is included in Appendix F.

Table 4.1 Static Gradient Survey

Depth (feet)	Pressure (psi)	PSI/ft
0	80.60	
500	296.59	0.432
1000	513.93	0.435
2000	948.17	0.434
3000	1381.99	0.434
3300	1512.40	0.435

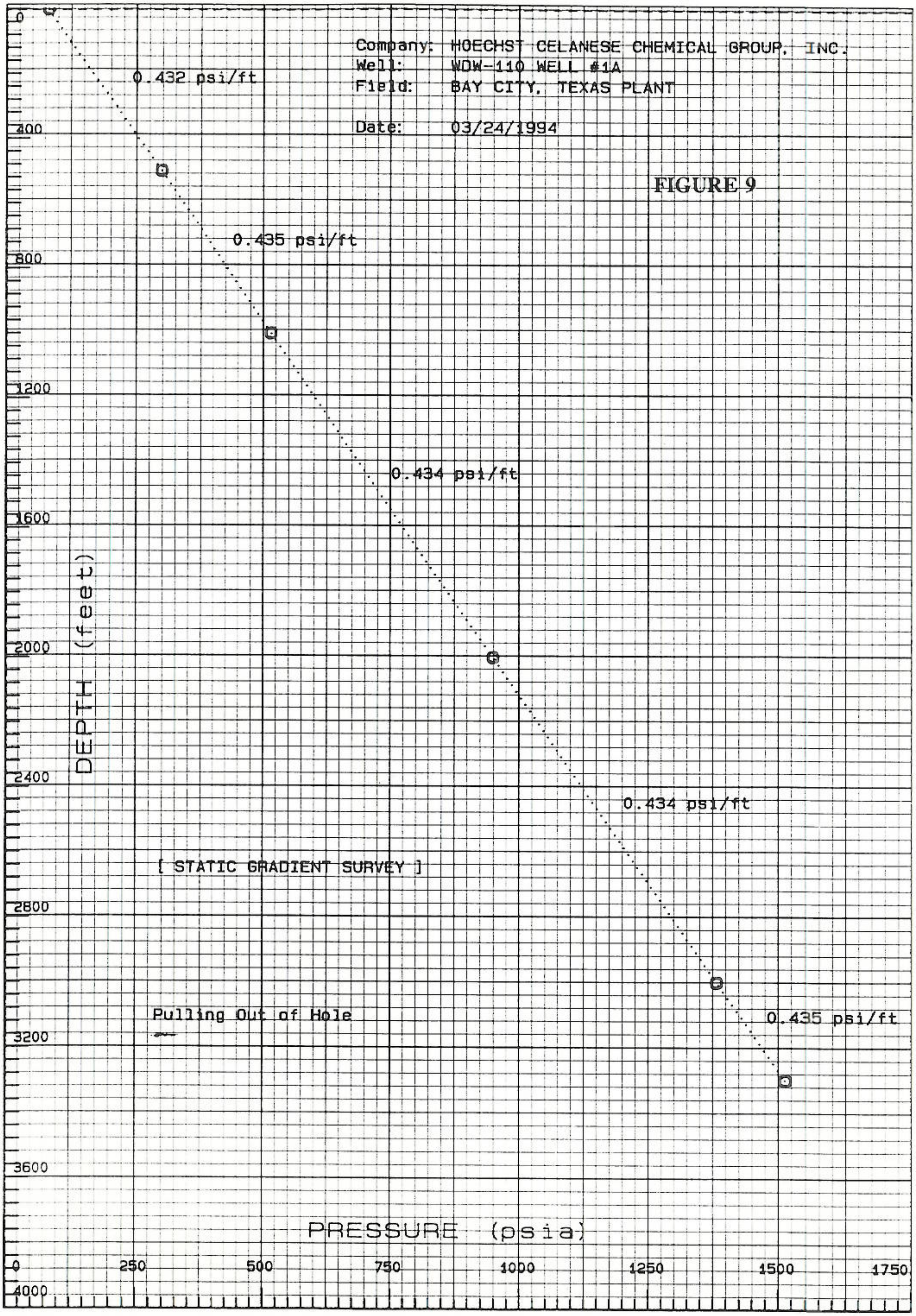

Company: HOECHST CELANESE CHEMICAL GROUP, INC.
Well: WDW-110 WELL #1A
Field: BAY CITY, TEXAS PLANT
Date: 03/24/1994
0.432 psi/ft
0.435 psi/ft
0.434 psi/ft
0.434 psi/ft
0.435 psi/ft
[STATIC GRADIENT SURVEY]
Pulling Out of Hole
DEPTH (feet)
PRESSURE (psia)
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
0
250
500
750
1000
1250
1500
1750

FIGURE 9

ECO Solutions, Inc.
Hoechst Celanese Chemical Group, Inc.
Pressure Falloff/MIT Testing

APPENDIX A

RADIOACTIVE TRACER SURVEY AND ATLAS WIRELINE SERVICES INTERPRETATION LETTER

DIAGNOSTIC RADIOACTIVE TRACERLOG

Hoechst Celanese Chemical Group, Inc.
Well No. 1-A
Bay City Plant
Matagorda County, Texas

Prepared for
ECO Solutions, Inc.
Houston, Texas

ATLAS WIRELINE SERVICES
WESTERN ATLAS INTERNATIONAL

March 25, 1994

Prepared by Freeman Hill, III

DISCLAIMER

In making interpretations of logs, our employees will give Customer the benefit of their best judgement, but since all interpretations are opinions based on inferences from electrical or other measurements, we cannot, and we do not guarantee the accuracy or the correctness of any interpretation. We shall not be liable or responsible for any loss, cost, damages, or expenses whatsoever incurred or sustained by the Customer resulting from any interpretation made/by any of our employees.

Disposal Well Background

The Hoechst Celanese Chemical Group, Inc.'s Injection Well No. 1-A, located at the Bay City facility has been used for underground injection. In addition to surface casing string, the well contains a string of 9-5/8 inch OD casing cemented to 5938 ft and 5.5 inch tubing and packer assembly, located at 3319 ft. (PBTD = 3802 ft; Fill = 3536 ft) Perforated interval from 3376 ft. to 3572 ft.

A logging program consisting of a Radioactive Tracer ejector and detector instrument was used to evaluate the integrity of the casing and cement and to verify that the injection interval had accepted the disposed fluids.

Radioactive Tracerlog Survey

1. Logged API gamma ray from well depth of 2981 ft to T.D.

   Purpose: Base-line for radioactive tracer instrument and post survey.

   Analysis: Gamma ray instruments respond to naturally occurring radiation (e.g., potassium, uranium, thorium) found in formations. Normally, shaly formations tend to contain more of these gamma ray-producing elements than a sand formation.

2. Logged gamma ray detectors off Radioactive Tracerlog from well depth of 2998 ft. to T.D. (3536 ft.)

   Purpose: A base-line for radioactive tracer instrument.

   Analysis: Baseline check - good. There were not any anomalies.

3. Repeat Step 2.

   Analysis: No anomalies noted.

4. While injecting into the well at 25 gpm, radioactive material (Iodine -131) was ejected from radioactive tracer instrument at 3113 ft. The instrument was lowered further into the well and then logged in the upward direction in order to intercept and detect the radioactive slug as it moved down the well. By repeating this process of lowering the instrument and logging in the upward direction, the radioactive slug was traced through the casing packer and into the injection interval located below.

   Purpose: Ensure injected fluids move through the tubing in a downward direction and that no upward or out of zone fluid movement through a cement channel is detected.

Analysis: The following table depicts the depths where the detector intercepted the radioactive slug as it moved with the surface-injected fluids downward toward the injection interval.

File #	Interception Depth ft. (Bottom Detector)
4	3182
5	3300
6	3390
7	3404
8	3412
9	---- - Dissipating

The radioactive peak responses from the first pass, file # 4, to file # 9 the last pass, become smaller, but cover a longer vertical interval, due to the movement of the wireline and instrument mixing the radioactive slug with the injected fluids. The radioactive material appears to continually move in the downward direction and into the disposal interval. There is no evidence of any problems.

5. Repeat step 4 (Chase Survey). (Pump Rate = 25 GPM)

Purpose: Ensure injected fluids move through the tubing in a downward direction and that no channel activity (fluid movement) to other zones above the target interval is detected.

Analysis: The following table depicts the depths where the detector intercepted the second radioactive slug (ejected at 4681 ft) as it moved with the injected fluids downward toward the injection interval.

File #	Interception Depth ft. (Bottom Detector)
10	3150
11	3250
12	3376
13	3402
14	3412 - Dissipating
15	---- - Dissipating

Again, the radioactive peak responses on the log become smaller (and wider) during the survey due to the mixing action of the wireline and instrument. The radioactive slug appeared to continuously move down to the disposal area. There is no evidence of any problems.

6. The tool was stationed at 3350 ft, above the disposal interval, for a stationary reading. The radioactive isotope is released and after the initial response to the isotope passing by the detector in a downward motion, then the isotope or an increase in radiation, should not be monitored again. If the isotope is seen again, then communication (channel behind pipe) is highly possible.

   Purpose: Ensure injected fluids move downward and not back up on the outside of casing in a channel, (Pump Rate - 100 GPM) (15-minute test).

   Analysis: After the initial response to the radioactive slug, the isotope did not come back into the tools' vicinity. No channel indicated.

7. Repeat step 6 (Stationary Reading). (Pump Rate - 100 GPM) (15-minute test).

   Purpose: Ensure injected fluids are not channeling up.

   Analysis: After the initial response to the radioactive slug, the isotope did not come back in the tools' vicinity. No channel indicated.

8. Logged gamma detectors from well depth 2946 ft. to T.D.

   Purpose: Monitor any anomalies or change in background baseline.

   Analysis: No unexplainable anomalies found.

9. Logged gamma detectors from well depth 2985 ft. to T.D. Repeat Step 8.

   Purpose: Monitor any anomalies.

   Analysis: No unexplainable anomalies found.

Conclusion:

In my opinion, the Hoecsht Celanese Well No. 1-A, located in the Bay City Plant, does not have any integrity problems that would result in disposed fluids migrating to intervals other than the injection zone. The logging program consisting of a radioactive tracer ejector and detector instrument should satisfy the annual mechanical integrity requirement.